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ABSTRACT

Melodic memory appears to be founded on building blocks that are memorized in terms of style-specific ordering rules, melodic prototypes, and memory strategies. Ordering rules concern musical form and construction, while melodic strategies involve sequences of several notes. This paper reports on research studies undertaken to test these concepts and examines student recognition and recall errors. Research indicates that both music domain-specific and general cognitive knowledge play important roles in supporting the memorization of musical melodies but that style-specific knowledge appears to be more critical in memorizing realistic and extended musical scores than general style or general cognitive knowledge. Figures and a seven item bibliography are included. (JHP)

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WHAT KIND OF KNOWLEDGE FACILITATES MEMORY OF MELODIES?

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My talk is about memorization of the realistic and extended melodies. I would like to propose an idea here. That is, melodic memory is founded on memory of building blocks consisting of a melody, being supported by music domain-specific, especially style-specific knowledge. I will present some experimental data supporting this idea. All the experiments I will introduce are collaborations with Dr. Hatano.

Most previous researches on melodic memory have dealt with stimulus variables, that is, characteristics of melodies which facilitate or inhibit memory. Stimulus melodies of these experiments were in general atonal or odd ones, and, in many cases, short melodies less than 7 notes.

However, there is no doubt that memory of the realistic and extended pieces of music can not be fully explained by a model based on research using unrealistic and short sequences of notes. Because, these short and odd melodies are quite different from those which we have heard in every day life in several critical points as follows. First, the realistic pieces of music we have heard consist of several tens of notes, and are well organized according to a central tone of scale. Secondly, a piece of music is made of several building blocks, which are arranged systematically in order to give a piece coherency and structure. Building blocks available in musical composition are limited by music style, because it is music style that determine what kinds of tone sequences are acceptable. In other words, these building blocks are common to musical works which belong to the same music style. People familiar with some style of music seem to have memorized lots of building blocks belonging to that style.

Because of these characteristics of the realistic pieces, melodic memory, in principle, seems to be founded on memory of building blocks consisting of a melody. These building blocks are expected to be memorized rather separately. In order to arrange those blocks in regular order, some information about the form of the melody, of course, need to be stored.

Now, what types of knowledge facilitate memory of building blocks and memory of arrangement of those blocks? I propose that three types of music domain-specific knowledge may contribute to melodic memory. Two of them are ordering rules and melodic prototypes. They seemingly correspond to sequencing rules and constituent units of story grammar proposed by Mandler and Goodman (1982). The third type of music domain-specific knowledge is melodic memory strategies.

Ordering rules are pieces of knowledge concerning the form and construction of music. Ordering rules can serve as a storage format and as a retrieval format. That is, with a rich set of ordering rules, one can recognize the form of a melody with ease, and then, arrange building blocks stored in regular order.

The second type of domain-specific knowledge is melodic prototypes which are sequences of several notes. Melodic prototypes are often used in actual melodies with or without pitch modifications such as inserting passing notes, ornamentation, repetition, etc. A prototype changes its appearance by attending modifiers and is transformed into various building blocks. A melodic prototype may be used as it is, or as a sequence of higher-order structural notes of a melody. The study by Pollard-Gott (1983), showing that musically experienced subjects could

abstract theme from its variations, suggests that the experienced students may be able to separate a prototypal tone sequence from a building block. With a rich set of melodic prototypes, one can code a novel melody into a series of building blocks, each consisting of a prototype and modification commands.

The third type of domain-specific knowledge is a set of melodic memory strategies. This type of knowledge is supposed to be more critical in recall than recognition. In order to recall a melody in a familiar style, one may rely on strategies for utilizing the ordering rules and prototypes. One may also use strategies for recalling a melody in an unfamiliar style, e.g., assigning syllable names and/or chord names to each of the component pitches.

When this idea about melodic memory is not wrong, two characteristic errors as follows will occur in reproductions of melodies.

1) As to the order of acquisition; Building blocks are expected to be memorized separately, so that those blocks may be wrongly ordered in reproduction, especially in the early phase of recalling a melody.
2) As to memory of building blocks; Each block seems to be made of a prototypal tone sequence and a few modifiers. The linkages between them are not so inevitable, so that some modifiers may be missed or be wrongly applied to another blocks in reproduction.

In order to examine these assumptions, a study as follows was planned. In this study (Oura & Hatano 1984), eight college students majoring in music who had had more than 13 years of piano training served as subjects. A commercial song broadcast more than 25 years ago

was selected as a stimulus melody (Figure 1). This song consisted of 12 measures or 64 notes. This song had clear tonality and was easy to sing. Its original version and a variant which differed by one note from the original were used as materials. The original was presented to half of the subjects, and the variant to the remaining half. The melody was presented ten times auditorily. After each presentation, the subject was required to reproduce it by playing the melody on a piano or by singing it. All the subjects preferred to play on a piano.

The subjects acquired the melody very quickly. On the sixth trial, all of them could reproduce the whole 12 measures in regular order with only a small number of erroneous notes. In regard to the order of acquisition, two types of it appeared. The one of it was to recall a melody always from the first measure. The other type of it was to recall several fragments, usually one, two or four measures, almost in a random order within a few trials, and finally with suddenness, the whole melody in regular order. For example, one of four subjects classified as this type reproduced from the first to the fourth measure on the first trial, from the 9th to the 10th on the second trial, from the 9th to 12th, and 5th to 6th on the third trial, from the first to the 12th on the fourth trial. This second type of acquisition suggested that the subjects segmented the melody into a number of building blocks, coded and stored those blocks in long term memory, and reproduced the melody by arranging those blocks according to the ordering rule.

Among the errors the subjects made, many were rhythm errors, especially wrong modifications of a part using a modifier that had been associated with another. The wrong modification error which all the

subjects made was to apply a syncopation rhythm pattern in other than 9th measure (Figure 2). This type of error suggested that the subject first separated the melody into prototypes and rhythmic modifications before storing, and combined them at the reproduction of the melody. These results suggest that melodic memory is founded on memory of building blocks and is supported, at least in part, by music domain-specific knowledge such as ordering rules, melodic prototypes and melodic memory strategies.

Constraints governing music , however, differ between styles or cultures as Meyer (1979) suggested. Thus, some pieces of music domain-specific knowledge may be not style general but highly style specific. For example, the number of notes constructing scale and the central tone differ between Western tonal music and Japanese folk music. Syntactic rules for closure, of course, differ between these two. Thus, melodic prototypes used in these styles of music are, in a greater part, quite different from each other.

Incidentary, recent research on understanding and memory of stories has suggested that both domain-specific substantive knowledge and general cognitive knowledge play an important role (e.g., Bisanz & Voss, 1981). Adding to music domain-specific knowledge, general cognitive knowledge may support the memory of melodies as well. General cognitive knowledge functions as a control process which integrates various kinds of data bases and procedures, which constitute a body of domain-specific knowledge. Though the nature of this general cognitive knowledge has not been specified in detail, part of it, for example, knowledge for selecting suitable mnemonic strategies and effective cues for memory,

are metacognitive. It has been well established that metamemory development accompanying chronological age facilitates memory (Fravell & Wellman, 1977).

Though these three kinds of knowledge, that is, general cognitive, music domain-specific but style-general, and style-specific ones may contribute to memory of melodies, it is not clear which is more critical in memorizing melodies. I would like to introduce next study consisting of three experiments. This study (Oura & Hatano, in press) was aimed at investigating which of these three kinds of knowledge would greater facilitate the storage and retrieval of a melody. Three groups of subjects participated in this study. That is, musically experienced college students (they will be called as the older experienced, hereafter), musically experienced 4th grade children (they will be called as the younger experienced), and musically unexperienced college students (they will be called as the unexperienced). Both musically experienced groups of subjects had had about 5 years of piano training and were expected to have lots of knowledge specific to Western tonal music. On the other, both college students groups of subjects were superior to children in regard to general cognitive knowledge. And these three groups of subjects have little amount of knowledge specific to Japanese folk song.

In experiment 1, contributions of the general cognitive skills and the music domain-specific skills were compared. Four older experienced students, four younger experienced students, and eight unexperienced students served as subjects. A material used was a commercial song

presented before. The song was presented ten times auditorily. After each presentation, the subject was required to reproduce it in singing.

Figure 3 shows the mean number of correctly recalled measures in each trial for each group. A two-way ANOVA revealed that both musically experienced groups, that is, the older experienced and the younger experienced were far superior to the unexperienced ones in the speed of acquisition as well as the eventual level of mastery of the melody. That is, not the general cognitive knowledge but music domain specific knowledge seems to be more critical in recalling a melody.

However, there can be an alternative interpretation. That is, both groups of musically experienced students had better memory ability in general, so that they could perform better on any memory tasks than the unexperienced students. In order to exclude this interpretation, non musical material, a poem, was used in experiment 2. Three older experienced students, four younger experienced students, and eight unexperienced students participated in experiment 2. The material was the first stanza of a poem and consisted of 16 sentence segments, each being made by one substantive word and a few functional words. The poem was presented auditorily five times. After each presentation, the subject was required to orally reproduce it. Figure 4 shows the mean number of correctly recalled sentence segments at each of the five trials for each group. A two-way ANOVA revealed that both older experienced college students and unexperienced college students could learn a poem significantly faster than the fourth grade children.

By these experiments, recall performance of the melody has proven to be facilitated by domain-specific knowledge in music. However, it is

not clear whether the knowledge was specific to Western tonal music or to music in general. In experiment 3, contributions of the style-general knowledge and the style-specific knowledge were compared. That is, how well the experienced in Western tonal music could memorize a traditional Japanese folk song was examined. Three older experienced students, four younger experienced students, and eight unexperienced students participated in this experiment. The material chosen was a folk song consisting of 26 measures or 50 notes. Procedure was the same as experiment 1. Figure 5 shows the mean number of correctly recalled measures at each trial for each group. A two-way ANOVA revealed a significant main effect for trials, but not for groups. These results suggested that the experienced students could not encode or chunk a Japanese folk song effectively. Style specific knowledge seems to be more critical in memorizing the realistic and extended pieces of music than style general and general cognitive knowledge. Although some strategies may be style general, these strategies make the melody presented not entirely new, and thus reduce the memory load, only with the stored prototypes and ordering rules.

Any way, I believe that use of style specific knowledge, for example, prototypes and ordering rules should be recognized as one of major reasons why people can memorize the realistic and extended pieces of music so quickly and accurately.

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Figure Captions

Figure 1. The tonal melodies used as the experimental materials.

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Figure 2. Wrong application of a rhythmic modifier.

Figure 3. Acquisition of the tonal melody by three groups.

Figure 4. Acquisition of the poem by three groups.

Figure 5. Acquisition of the non-tonal melody by three groups.

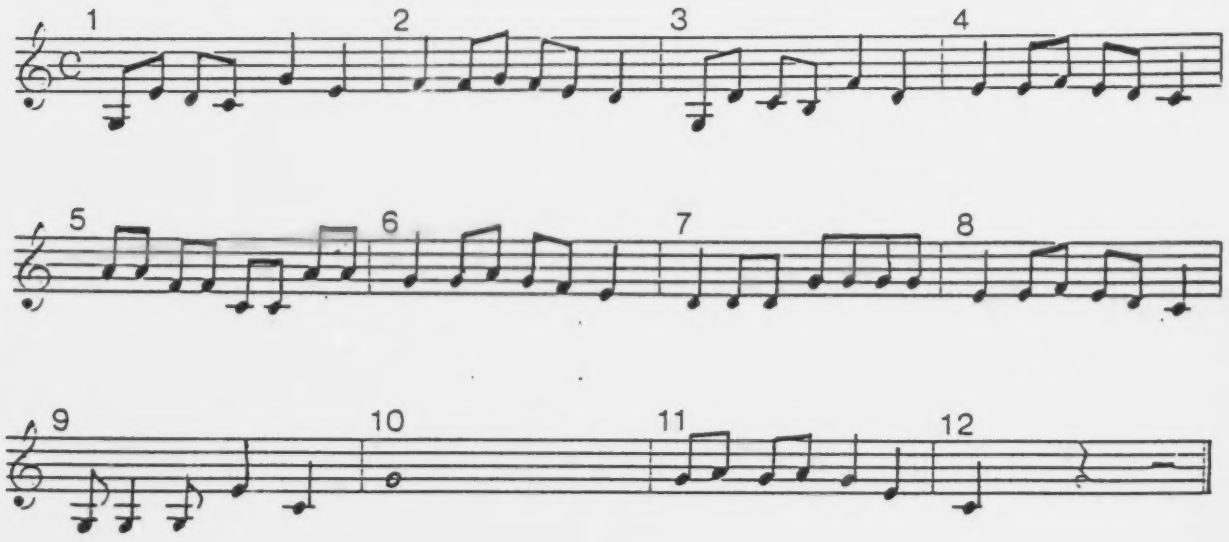



Figure 1.

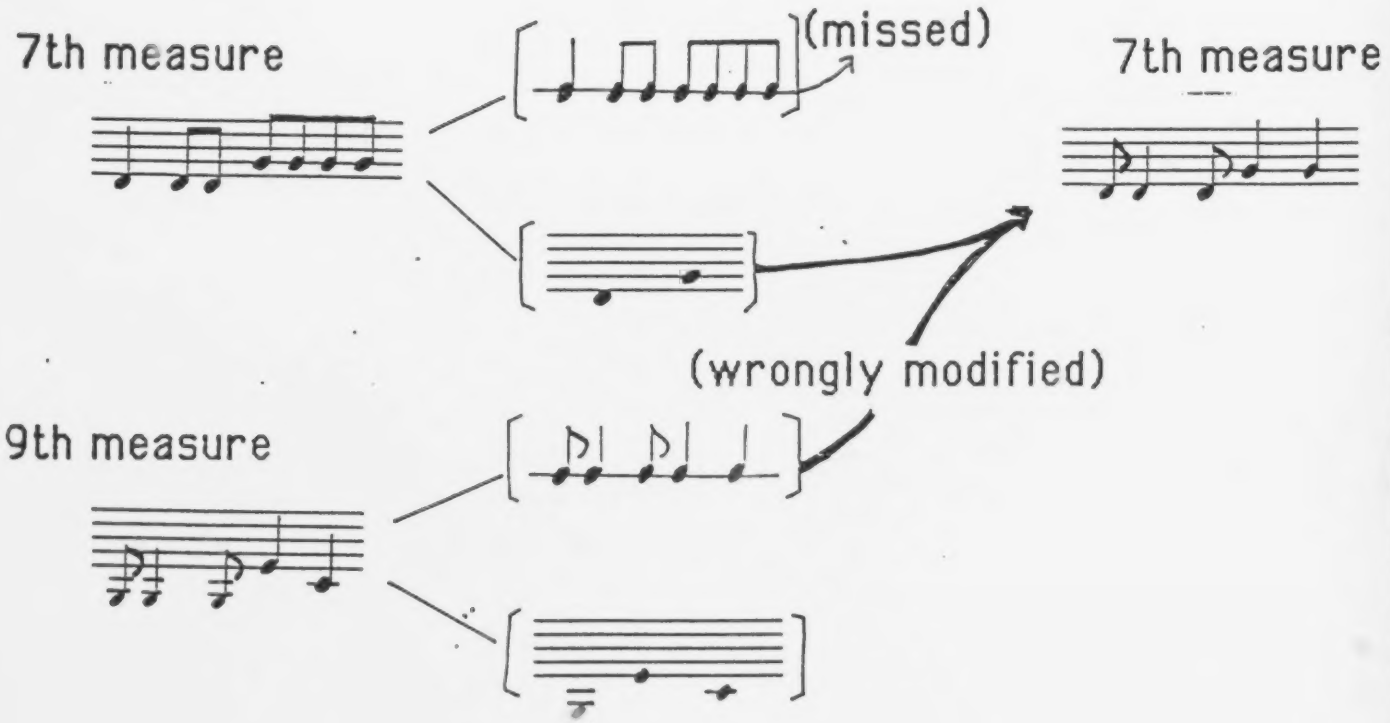
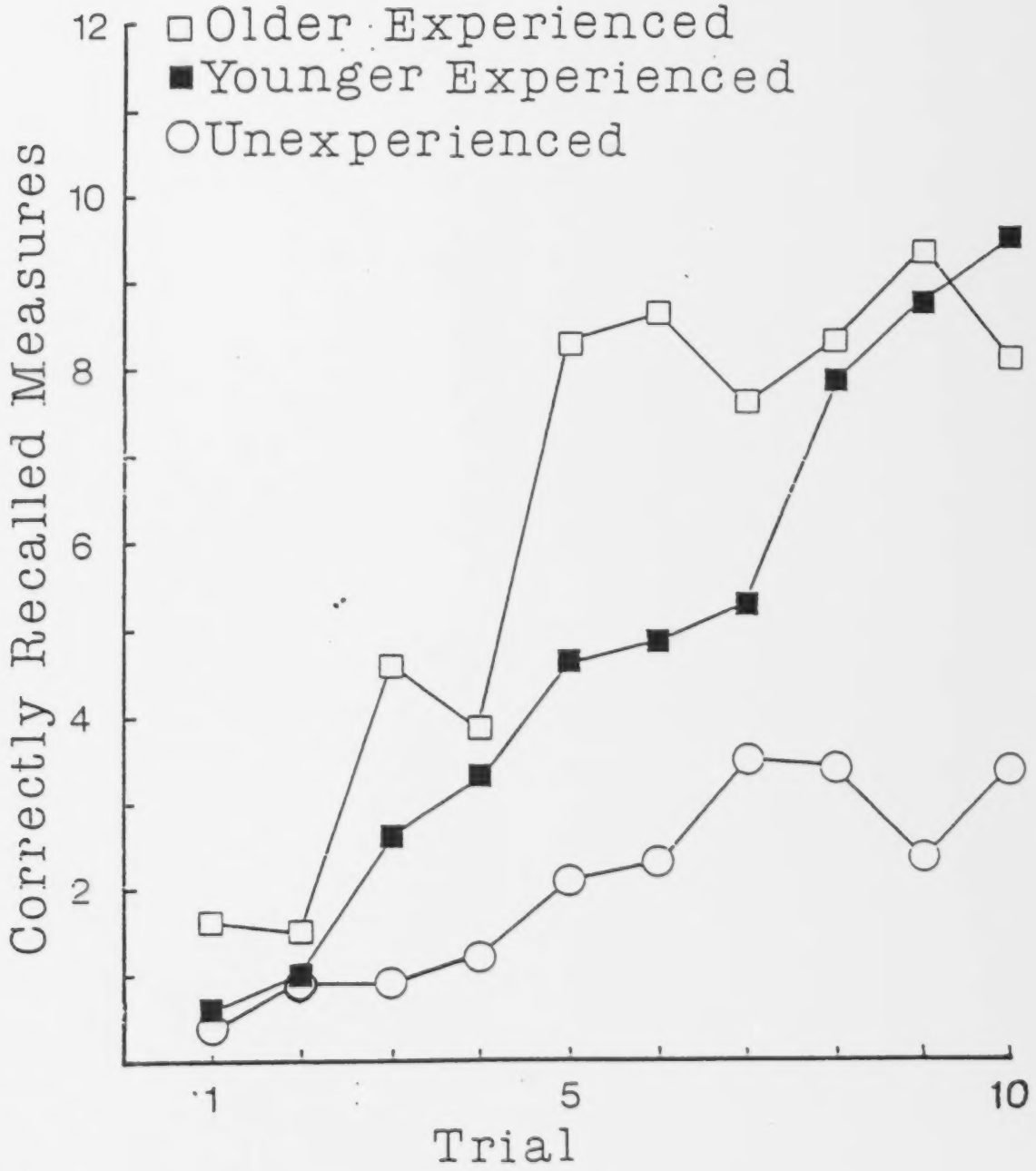

presented
reproduced
7th measure
(missed)
7th measure
(wrongly modified)
9th measure

Figure 2.



This melody consisted of 12 measures or 64 notes

Figure 1.

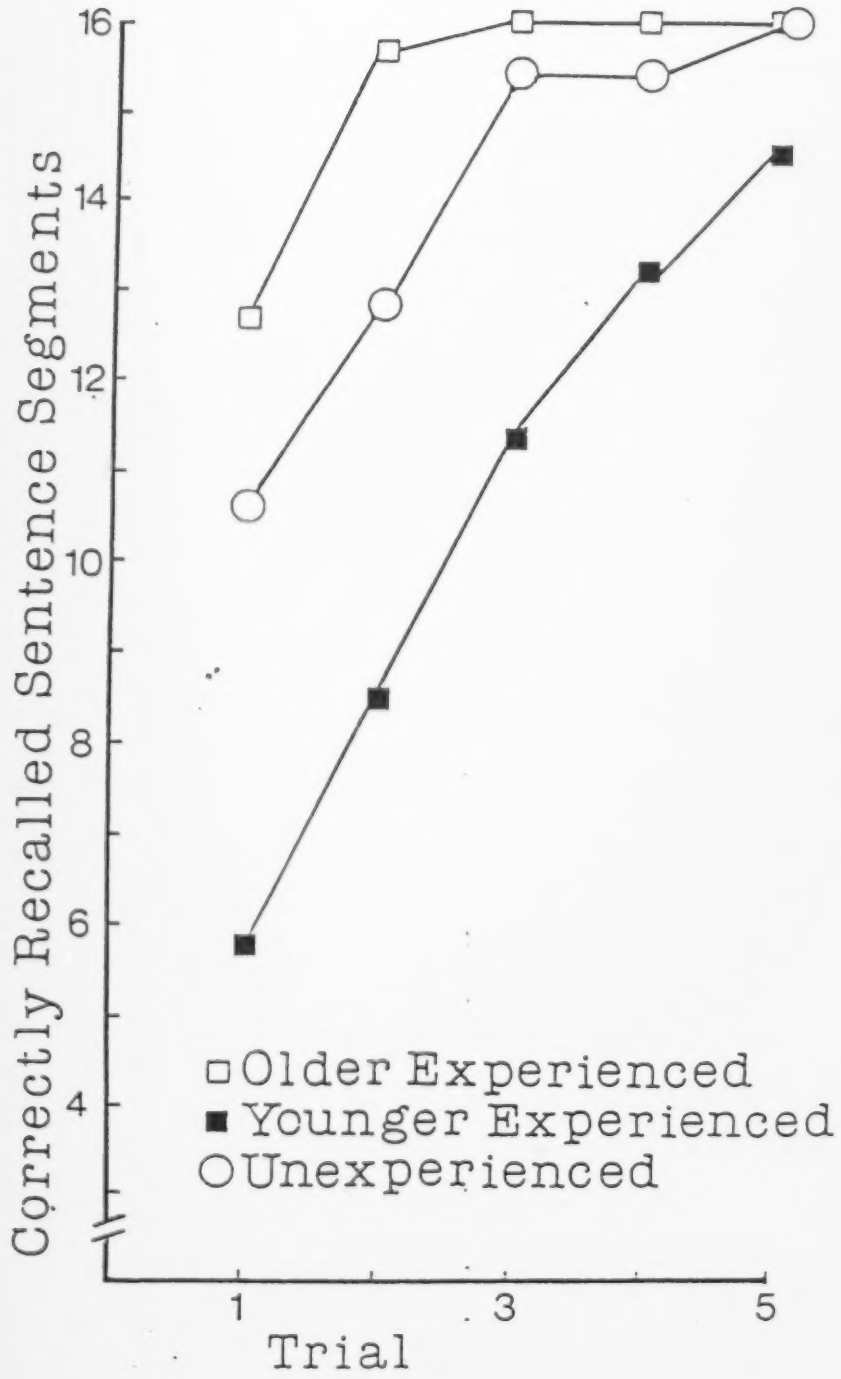
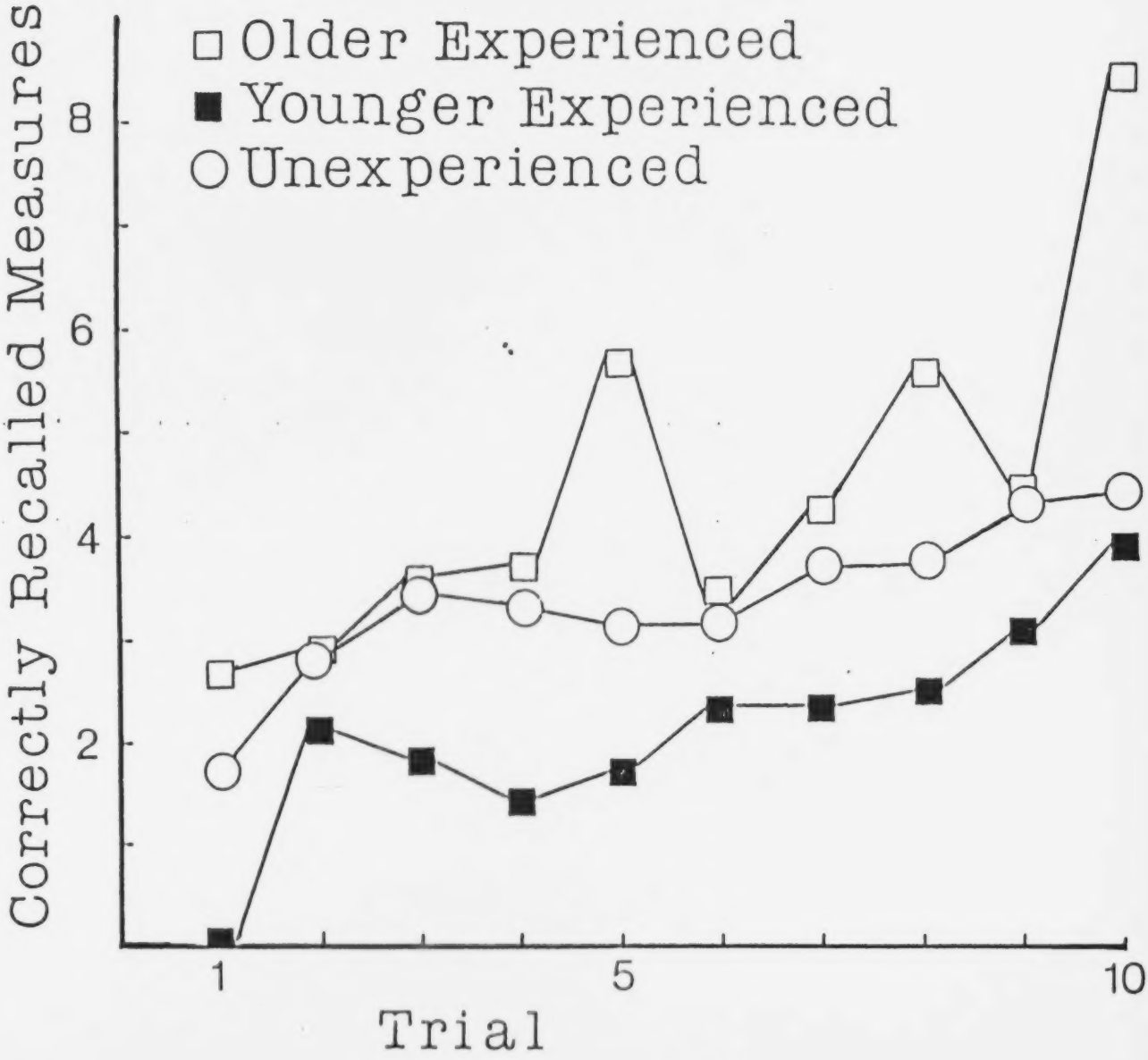

Correctly Recalled Sentence Segments
16
14
12
10
8
6
4
Older Experienced
Younger Experienced
Unexperienced
1
3
5
Trial

Figure 4.



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This melody consisted of 26 measures or 50 notes